ISU Biotechnologists Take Aim at Animal and Human Disease

Iowa State University has a solid commitment to academic and research prowess in molecular biology where infectious animal diseases are concerned. That strength often leads to breakthroughs in treatment and prevention of human diseases. The following are a small sample of ongoing studies taking place in the College of Veterinary Medicine.

Researchers in the College of Veterinary Medicine are studying contagious diseases from many different angles. Lisa K. Nolan, Professor and Chair of the Department of Veterinary Microbiology and Preventive Medicine, and Nancy Cornick, an associate professor in the same department, focus on bacterial diseases of production animals, including their effects on animal and human health and food safety. The long-term goals of their research are to establish the molecular basis of virulence and antimicrobial resistance of different types of *Escherichia coli* and to apply this knowledge to disease control. Nolan’s research team seeks to understand how extraintestinal pathogenic *E. coli* (ExPEC) causes diseases such as peritonitis, colisepticemia, air sacculitis, and cellulites of poultry and urinary tract infection, septicemia, and neonatal meningitis in human beings.

Cornick’s research group is focused on intestinal *E. coli* pathogens, particularly the Shiga toxin-producing strains (STEC) that cause disease in both humans and piglets. One focus of their research is to understand the colonization mechanisms underlying the carrier/shedder state in ruminants. These animals serve as a reservoir for the STEC organisms but do not become ill themselves. Understanding the pathogenesis of STEC disease is another focus of the lab. Edema disease is a naturally occurring infection of young piglets that has many similarities to the systemic disease in children caused by O157:H7. Exploring the basis of the disease in piglets may lead to new insights and potential treatments for children infected by these organisms.

Understanding West Nile Virus (WNV) in the animal population could have a benefit for humans. Bradley Blitvich, Assistant Professor of Veterinary Microbiology and Preventive Medicine, specializes in arthropod-borne viruses (arboviruses) and their mosquito vectors. His primary research focus is to define the vector and the host and viral determinants of the epidemic potential of West Nile Virus in Mexico. He is also interested in characterizing the genetic basis of programmed cell death regulation in mosquito vectors.

The laboratory of Bruce Janke, Professor of Veterinary Diagnostic and Production Animal Medicine, working in collaboration with scientists from around the Midwest, has identified and characterized a subtype of swine influenza that had not been isolated previously from that species. The virus H2N3 is a subtype of influenza A virus that is found frequently in birds, but never before in hogs. This virus contains genes from both avian and swine influenza viruses. This is very important since this is the first time H2 virus has been found in a mammalian species other than humans. Experimentally, the virus also was able to infect mice and ferrets.

Researchers think the swine were infected because water from ponds where migrating waterfowl congregated was used for cleaning barns and watering the pigs. Janke says the crossover is a concern because the virus found in the pigs is of the same HA subtype of influenza virus that caused the Asian flu epidemic in 1957, which was an H2N2 strain. Currently, type influenza A strains found in humans are normally H1 or H3 subtypes.

Premature human infants may benefit from the work of Mark Ackermann, Professor of Veterinary Pathology. Ackermann studies molecular mechanisms of innate immunity of respiratory epithelia to pulmonary pathogens such as Re-
spiratory Syncytial Virus (RSV) in preterm lambs. RSV is most severe in preterm infants, and lambs develop disease quite similar to those seen in human infants. Ackermann’s research focuses on the mechanism by which preterm birth and preterm intrauterine stresses may alter expression of key innate immune genes that may underlie susceptibility to RSV infection. His laboratory has found that preterm lambs have reduced innate immune gene expression that correlates with increased RSV susceptibility. They have discovered that maternal consumption of ethanol or nicotine further reduces innate immune gene expression.

**Biotechnology News**

**New Look for Office of Biotechnology Web Site**

The Office of Biotechnology Web site has a new look and expanded features while still keeping all the useful information the site has always featured. A new drop-down menu at the left of the screen provides a quick way for visitors to find what they need.

Suggestions for further improvement to the site are welcome. Emails may be sent to Camie Stockhausen at camstock@iastate.edu.

**Gaya Amarasinghe** joined the Department of Biochemistry, Biophysics and Molecular Biology in September 2007 as an assistant professor. He obtained his Ph.D. from the University of Maryland, Baltimore County, in chemistry with an emphasis on biophysical chemistry. There, he characterized the HIV-1 packaging signal and its interactions with the HIV-1 nucleocapsid protein by nuclear magnetic resonance spectroscopy (NMR). He then conducted postdoctoral research at Memorial Sloan Kettering Cancer Center in New York and at University of Texas Southwestern Medical Center in Dallas to examine the regulatory properties of multi-domain signaling proteins using biochemical and structural methods.

His research program at ISU examines cellular and viral components at a molecular level in order to characterize the structural basis of antiviral innate immune signaling using biochemical and biophysical methods, including NMR.

Amarasinghe can be reached by phone at (515) 294-3216 or email at amarasin@iastate.edu. His office is located in 4210 Molecular Biology Building.

**Ravindra Singh** joined the Department of Biomedical Sciences, College of Veterinary Medicine, in July 2007 as an associate professor. He is also a member of four interdisciplinary graduate programs: Molecular Cellular and Developmental Biology, Neuroscience, Toxicology and Genetics. He received the 2006 Presidential Early Career Award for Scientists and Engineers or PECASE award, which is the highest civilian award given to young U.S. scientists.

Since January 2008, he has been named Dr. John G. and Mrs. Doris Salsbury Endowed Chair. He earned his Ph.D. in 1993 in biochemistry from the Russian Academy of Science, Pushchino, Russia. He did three postdoctoral trainings at the University of Texas MD Anderson Cancer Center, Houston, TX; Oregon State University, Corvallis, OR; and the Institute for Cellular and Molecular Biology, University of Texas at Austin, TX. Before joining ISU, he worked as an assistant professor at the University of Massachusetts Medical School, Worcester, MA. He has served as the ad hoc member of several journals and funding agencies, including the Department of Defense and the National Institutes of Health.

He specializes in different aspects of RNA-protein interactions and pre-mRNA splicing, a fundamental process that increases the coding potential of the human genome. His current focus is on understanding the molecular mechanism of spinal muscular atrophy (SMA) that affects children and infants. His award-winning discovery relates to the identification of a regulatory element in the noncoding region of the Survival Motor Neuron (SMN) gene. His discovery of this novel element provides a powerful therapeutic target that could be used for gene correction and for a cure of SMA. His long-term goals include understanding the role of alternative splicing in human and animal diseases. His laboratory is currently supported by grants from the National Institutes of Health and the Muscular Dystrophy Association.

Singh can be reached by phone at (515) 294-8505 or email at singhr@iastate.edu. His office is located in 2034 Veterinary Medicine.
Available Technologies

Iowa State University is seeking industrial partners to develop and/or commercialize the following technologies. For more information or for a complete listing of all available technologies, contact the Office of Intellectual Property and Technology Transfer at 515-294-3893 or www.techtransfer.iastate.edu/.

Build a Better Gene Chip

Iowa State University researchers have developed a software tool that makes designing gene chips easier, faster and with improved quality. PICKY is a software tool for selecting optimal oligos. PICKY allows the rapid and efficient determination of gene-specific oligos based on a given gene set and can be used for complex genomes, such as human, rice or maize. Gene probe sets can be designed in only minutes or hours, compared to other design tools that take days or weeks for large genomes. The program also can be used to analyze the quality of existing arrays. PICKY does not require any third party software program to operate.

Non-exclusive free licenses are available for research institutions; commercial licenses are also now available. For more information or to download a demonstration of PICKY, for Mac, Windows or Unix, visit http://www.complex.iastate.edu/download/Picky. ISURF #3554

Reverse Genetics in High Gear

Iowa State University researchers have developed an improved genetic tool for researching and understanding soybean genomics. Virus-Induced Gene Silencing (VIGS) is a new approach to so-called reverse genetics. Using this technology, the expression of a known gene or sequence is altered and the resulting effect on plant phenotype is investigated. VIGS is being increasingly used to study and identify functions of specific plant genes. While RNA-based VIGS vectors have been developed for investigating gene function in soybean, they are subject to RNA degradation, are not easy to manipulate, require in vitro RNA transcription and are costly and time consuming. To overcome these drawbacks, Iowa State researchers have developed a highly reliable soybean gene expression and silencing vector. This improvement is based on DNA inoculation and uses a Cauliflower mosaic virus (CaMV) promoter driven Bean Pod Mottle Virus (BPMV) vector. Because the DNA-based BPMV vector is designed to silence multiple genes using a single construct, simultaneous testing of different combinations of genes to address questions related to genetic redundancy or epistasis is possible. In addition, the vector can be used in soybean to validate the function of Arabidopsis gene homologues. ISURF #3585

Upcoming Events

May 7-9 — Nutrition Wellness Research Center Annual Symposium “Gut health: Mechanisms of Diet, Microbes and Immunity.” Gateway Center in Ames, Iowa. Speakers from academia and industry on topics including research frontiers in connecting diet and exercise with gut health, roles of gut microbes in absorption and metabolism of dietary bioactive components such as phenolics and dietary fibers, and effects of exercise and dietary habits on gut microbial populations and pathogenic microbes. Issues related to gut environmental impacts on microbial genetics. Molecular mechanisms of action will be the focus of many presentations. Information: www.fshn.hs.iastate.edu

July 10 — Iowa State University Economic Development Open House. Details at: www.industry.iastate.edu/openhouse/

Research Update

The following are a subset of the grants recently awarded for biotechnology-related research at ISU. For more information about establishing research relationships with ISU biotechnology researchers, please contact Lisa Lorenzen at llorenze@iastate.edu.


Dickerson, J. Electrical and computer engineering. GEPR: Functional genomics of bud endodormancy induction in grapevine. South Dakota State University

Grozdanic, S., Sakaguchi, D., Veterinary Clinical Sciences; Genetics, Development and Cell Biology. Treatment of visual loss in glaucoma and ischemia with neurotrophic growth factors. Department of Veteran Affairs

James, M., Biochemistry, Biophysics and Molecular Biology. Enhance economic value of sweet potato by developing specialty cultivars optimal for novel dietary application using genomics and biotechnology approaches. Alcorn State University

Jernigan, R., Culver, G., Biochemistry, Biophysics and Molecular Biology. Modeling ribosomal control, function and assembly. National Institutes of Health

Johansen, K., Johansen, J., Girton, J., Biochemistry, Biophysics and Molecular Biology. Regulation of chromatin structure and gene expression. National Institutes of Health
Kariyawasam, S., Trampel, D., Harmon, K., Veterinary Diagnostic and Production Animal Medicine, Veterinary Microbiology and Preventive Medicine, Veterinary Microbiology and Preventive Medicine. Development of multiplex RT-PCR for simultaneous detection of viruses causing enteritis in turkeys. Iowa Turkey Federation


Nilsen-Hamilton, M., Biochemistry, Biophysics and Molecular Biology. Tracking stem cells with imagnetags. National Institutes of Health

Shanks, B., Chemical and Biological Engineering. PIRE: Molecular engineering for conversion of biomass-derived reactants to fuels, chemicals and materials. University of New Mexico

Singh, R., Biomedical Sciences. Characterization of a complex regulatory element of spinal muscular atrophy genes. National Institutes of Health

Sponseller, B., Jones, D., Veterinary Microbiology and Preventive Medicine; Veterinary Pathology. Are foal dendritic cells effective promoters of a T helper 1 response? Morris Animal Foundation

Spurlock, D., Dekkers, J., Fernando, R., Animal Science. Genetic regulation and genomic selection of energy balance traits in dairy cattle. United States Department of Agriculture


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